The ASTER Emergency Backup System

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ABSTRACT:

The ASTER Emergency Backup System (AEBS) provides limited post AM-1 platform launch capability for data ingest, processing and distribution of ASTER level 1 and level 2 products to the ASTER Science Team. This system is designed based on a request from the Goddard Space Flight Center's (GSFC) Earth Science Data and Information System (ESDIS, part of the Mission to Planet Earth) Project Manager when the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) contractor slipped delivery schedules.

The AEBS provides the capability to ingest, archive, and catalog ASTER level 1A and level 1B scenes from Japan at the EROS Data Center (EDC) Distributed Active Archive Center (DAAC) in Sioux Falls, South Dakota. Capability is provided to synchronize the level 1A and level 1B catalog database at EDC and the level 1A and level 1B catalog database at the Science Computing Facility (SCF) at the Jet Propulsion Laboratory (JPL) in Pasadena, California. The AEBS provides a simple search and order of level 1A and level 1B catalog at the JPL SCF to the ASTER Science Team, and provides the capability to generate and distribute ASTER level 2 products to the ASTER Science Team. The AEBS allows for automatic QA of products on a routine basis. Manual QA is performed at the discretion of the ASTER Science Team Leader at JPL SCF.

This paper discusses the international aspect of the ASTER project by specifying data flow among Japan, the EDC DAAC, the JPL SCF, The Goddard Space Flight Center (GSFC), and the ASTER Science Team. A discussion of the design of the archive and catalog systems at EDC DAAC and at JPL SCF is also provided.

OVERVIEW:

A distributed heterogeneous data base system needed to be developed as part of an overall science data processing system at JPL in order to provide limited ordering, production, and distribution of ASTER products to the ASTER science team members after the launch of the EOS AM-1 platform. This distributed data base system consists of an ORACLE database at the EDC and a SYBASE database at the JPL.

The basic requirement of the AEBS is to provide the capability to synchronize ASTER level 1A and level 1B catalog systems at the EDC and the JPL, and to provide on-line search and order capability of ASTER level 1A, level 1B, and level 2 scenes to the ASTER science team members. In addition the AEBS is required to provide the capability for generation of a limited number of ASTER level 2 products at JPL, and for on-line distribution of those products to the ASTER science team members. Level 2 processing requires access to the Digital Elevation Model (DEM) and the NOAA National Center for Environmental Prediction (NCEP) data, available through the GSFC DAAC. The hardware available to the ASTER SCF at the JPL for processing level 2 products is an SGI Power Challenge.

A JAVA front end for product search and order was developed for use by the ASTER science team members. Use of JAVA simplified the implementation of the user interface task and allowed generation of one version of the interface to support a heterogeneous ASTER science team environment.

The overall data flow of the AEBS is shown in figure 1. ASTER data is received by the EOS Data Operations System (EDOS) and converted to level 0 data. Level 0 data is transferred to Ground Data System (GDS) in Japan for conversion into level 1 data. On a daily basis, ASTER GDS in Japan sends three D3 tapes containing Level 1A and 1B data to the EDC for further processing, archiving and distribution. In the nominal case, the EDC would provide access to the ASTER science community and perform further processing and distribution of ASTER level 1 data.
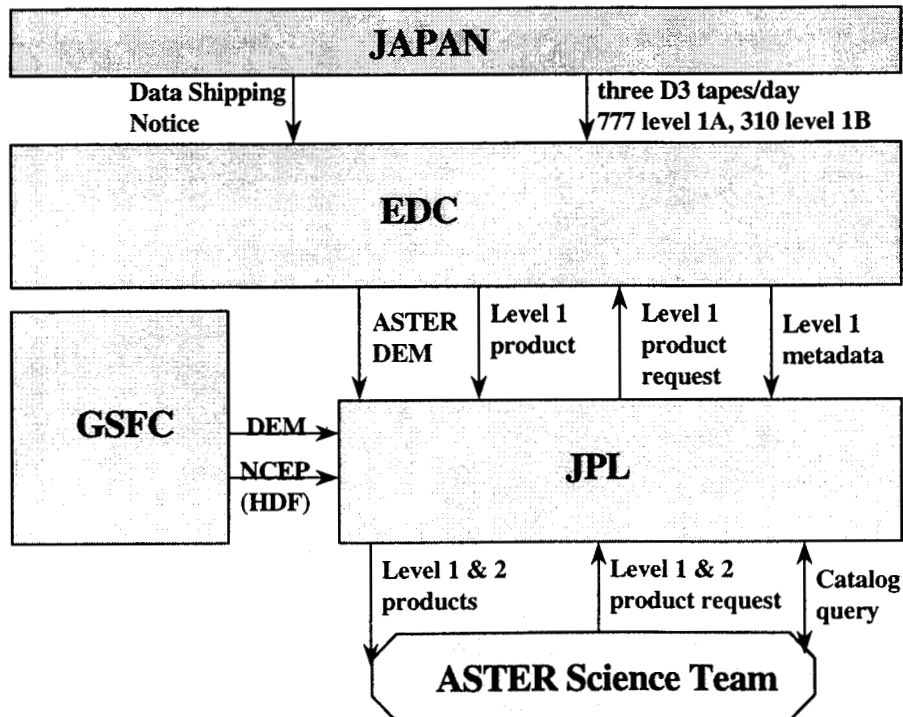

Figure 1.0 AEBS Overall Data Flow

However, due to delay in delivery of the ECS system to EDC, it became necessary for JPL to develop an emergency backup system to provide on-line user access to level 1A and level 1B catalog and the capability to accept orders, and generate higher level products at JPL for the ASTER science team members. In order to accomplish this task, bulk of ASTER level 1A and 1B scenes would reside at the EDC. The JPL AEBS would request and receives only those scenes that are required for further processing by the ASTER science team members on a priority basis established by the ASTER science team leader. In addition, since access to the level 1A and 1B catalog metadata was not available at the EDC, a mirrored database at the JPL AEBS was designed and implemented to provide the latest ASTER level 1 catalog database available to the ASTER science team members.

This paper discusses the AEBS in four sections. In the first section, ingestion and archive of ASTER level 1A and 1B scenes is discussed. Second section specifies user search and ordering of level 1 scenes. Third section discusses the level 2 product request. Last section provides a brief overview of the level 2 processing capability at the JPL SCF.

1.0 LEVEL 1 DATA INGEST AND ARCHIVE:

A simple mechanism for synchronization of level 1A and level 1B ASTER scene metadata information between EDC and JPL is developed. This mechanism is critical for access to level 1A and 1B data and for requesting generation of ASTER level 2 data by the ASTER science team. During the development phase of the catalog metadata, JPL and EDC produced a design that while served the unique needs of each organization, assured existence of common key cataloging parameters such as spatial and temporal fields for categorizing the ASTER level 1A and 1B scenes. In addition a process was established to provide regular updates to the JPL metadata database by the EDC as well as automated updates to the JPL metadata database whenever a change in the EDC metadata database became necessary. In this design, the EDC metadata database acts as the master and the JPL metadata database acts as the slave database.

After launch of the EOS AM-1 platform, the ASTER instrument data will be processed to level 0 by the ECS EDOS and forwarded to GDS in Japan for further processing. The GDS in Japan will process level 0 data into 777 level 1A and 310 level 1B ASTER scenes on a daily basis and sends three D3 tapes along with an electronic Data Shipping Notice (DSN) to the EDC.

Upon receipt of each shipment, the EDC checks the content of shipment against the DSN, extracts metadata information from each level 1 scene and creates a level 1A/1B catalog at the EDC (metadata database). The D3 tapes are archived in a D3 tape library (see figure 2). The metadata database is maintained using an ORACLE database management system.
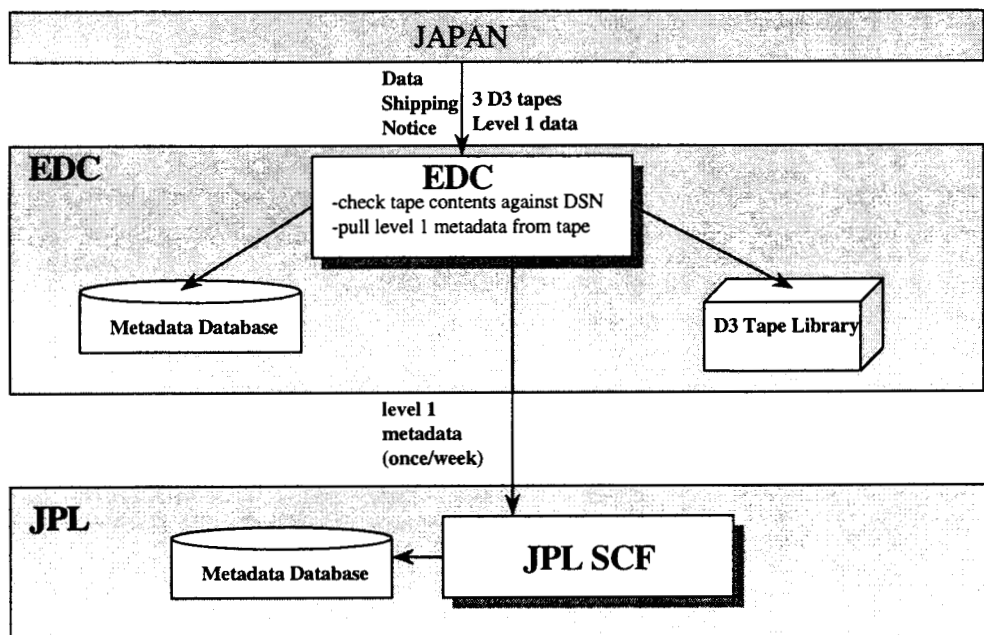

Figure 2.0 Level 1 Data Ingest and Archive

On a weekly basis, the EDC generates an ASCII file containing new and updated catalog entries and transfers them to AEBS at JPL. In addition updates to the EDC metadata database that could impact level 1 search results (due to updates from the GDS in Japan or based on changes at the EDC) cause an immediate database update message to the JPL AEBS. The AEBS at JPL ingests the catalog entries file from EDC and updates a level 1A/1B catalog (metadata database) maintained using a SYABSE database management system. The Catalog database at the JPL is accessed by the ASTER science team to view the available ASTER scenes and to place level 1 or level 2 processing orders.

2.0 LEVEL 1 PRODUCT REQUEST:

The AEBS provides the capability for the ASTER science team to order ASTER level 1 scenes. No further processing of these scenes is performed at the AEBS. It is expected that the ASTER science team would have sufficient resources to store these scenes, and to perform further (i.e. level 2) processing. Figure 3 shows the level 1 product request data flow among the EDC, the JPL, and the ASTER science team.

A web-based interface is provided to the ASTER science team members to access the ASTER level 1 scenes metadata database at the JPL. This capability was developed in the JAVA programming language and therefore, can be used by any hardware platform available to the ASTER science team members. This interface provides for spatial and temporal searches of the level 1 scenes in the metadata catalog at the JPL. Once the desired scenes are found, the AEBS provides an on-line capability to allow ASTER science team members to place an order to receive the level 1A and/or 1B scenes. The Science Computing Facility (SCF) as part of the AEBS at JPL, with the help of the ASTER Science Team Leader, prioritizes all level 1 orders. Up to ten high priority level 1 product requests are forwarded to the EDC by the JPL AEBS. This limitation is due to the limited hardware resources and facilities available to the JPL the EDC prior to the full installation of the ECS. As part of the design for maintaining a distributed database system, the JPL AEBS provides the capability to query the EDC metadata catalog to make sure that the metadata database at JPL and the metadata database at the EDC are still synchronized prior to placing the order.

Once level 1 orders arrive at the EDC, the location of each level 1 scene requested is determined by queries to the EDC metadata database. The desired level 1 scenes are read from the D3 tape archive and staged directly to an FTP site at JPL. Once the level 1 scenes are transferred successfully, the EDC notifies the JPL AEBS, via a data availability Email, that level 1 scenes are available for access.

The JPL AEBS checks the content of the FTP site against the original order and the data availability Email and notifies the ASTER science team members who placed the order(s) of the availability and location of data. After level 1A and/or 1B data is retrieved by the ASTER science team, the AEBS will erased it from the FTP site. Figure 3 shows the level 1 product request data flow.

EDC

Metadata Database

D3 Tape ID
Location

EDC
User Services

D3 Tape ID and Location

D3 Tape Library

Level 1
product
request

EDC Operations

JPL

FTP Site

Level 1 products

Data availability
notice (Email)

Level 1
products

Metadata Database

Data availability
notice (Email)

ASTER Science Team

SCF
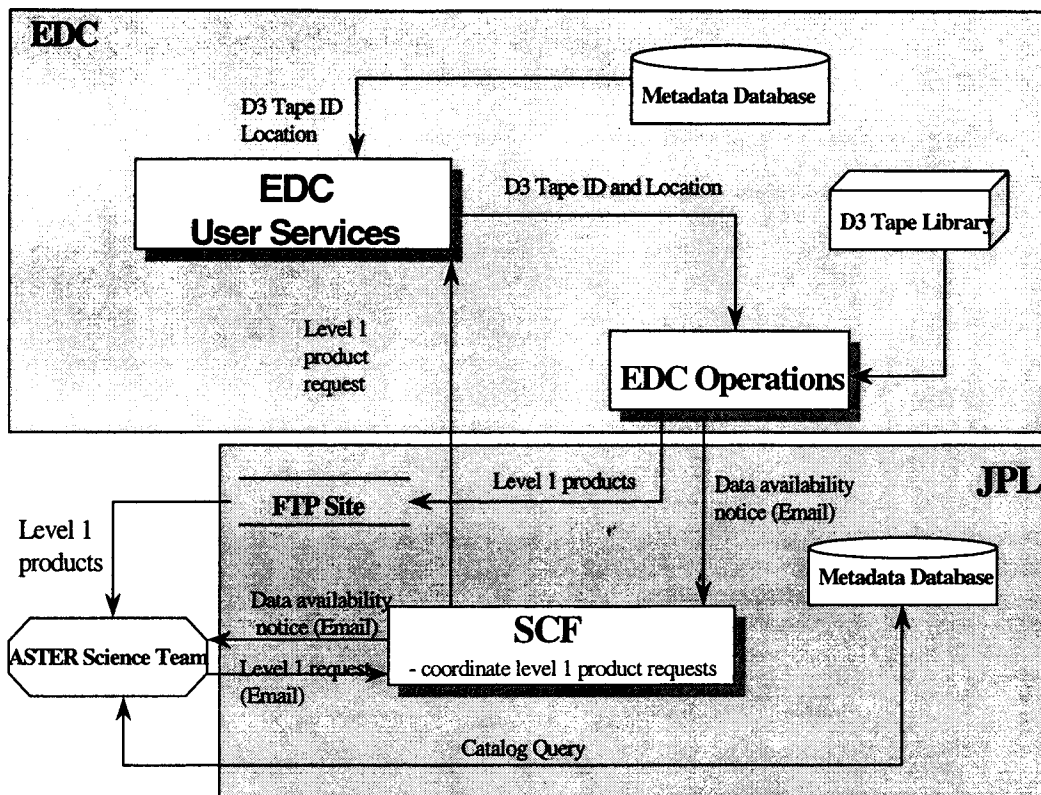- coordinate level 1 product requests

Level 1 request
(Email)

Catalog Query

Figure 3. Level 1 Product Request